

DIURNAL VARIATIONS OF THE PHYSIOLOGICAL MOBILITY
OF HUMAN TEETH

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16. Abstract An experimental system for measuring the diurnal variation of the physiological mobility of human teeth is reported. It is based on strain gauges. The major result of the studies is that the physiological mobility of the teeth is subject to spontaneous rhythmic variations with a cycle of 48 hours.			
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As part of the Special Research Area 122, Adaptation and Rehabilitation, we are presently establishing a model for study of the adaptation of the human chewing organs to slight occlusal interferences.

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In this respect, we have already learned that an inter-occlusal gap is the least between 6:00 PM and 8:00 PM in normal living men, and that the amount of this gap oscillates about a mean after 5 to 6 days. We are at present investigating whether rows of teeth will again get farther apart. We also saw a significant relation in the variation of the amounts of the interocclusal gap with synchronous changes in the tactility of the teeth.

In order to find a reason for the variation in tactility of the teeth, we studied the varying physiological degree of looseness of the teeth, which depends on the time of day. In particular, we studied the upper central front teeth, once in the course of the day, and also in the course of a week. In this way we were able to gain an indirect disclosure of the varying blood supply of the periodontium.

* Numbers in the margin indicate pagination in the original foreign text.

Methods

In a preliminary experiment we were able to show that if the periodontium is largely desanguinated medicinally, it causes the teeth to be tightened in their sockets. Our experimental system consisted of two measuring devices which one of us developed for this purpose, a device for applying force and a motion pickup.

The forcing device (Figure 1) consisted of a hand grip, a deformable metal plate carrying a strain gauge, and a plunger at the free end.

The strain gauge was 3.5 cm behind the plunger. On compression or extension, its ohmic resistance changed. After appropriate calibration, the galvanometer recorder (Physioskript EE 12 from the Schwarzer Company) combined with a Wheatstone bridge plotted the deflection of the teeth in the form of curves.

A pressure was exerted horizontally on the tooth with the hemispherical plunger of the forcing device. To measure the deflection of the tooth from its socket, we fastened a leaf spring (20 x 7.5 x 0.15 mm) with strain gauges palatally to the tooth to be measured in each sample (Figure 2).

The localization of the measuring point for force transfer and for the contact with the motion pickup were chosen so that both the point of applying force and the point of motion pickup were in the imaginary line of the direction of pressure. As the tooth behaves in the physical sense like a two-armed lever, the point of force application is of special importance.

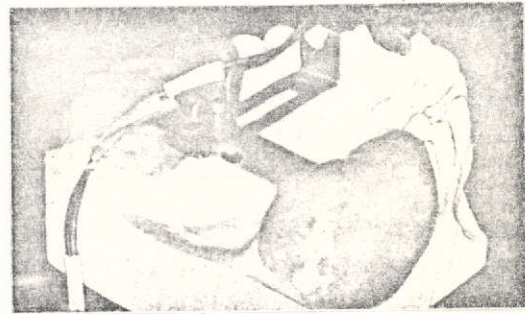
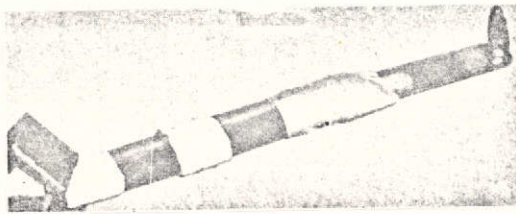


Figure 1. The forcing device.

Figure 2. The motion pickup.

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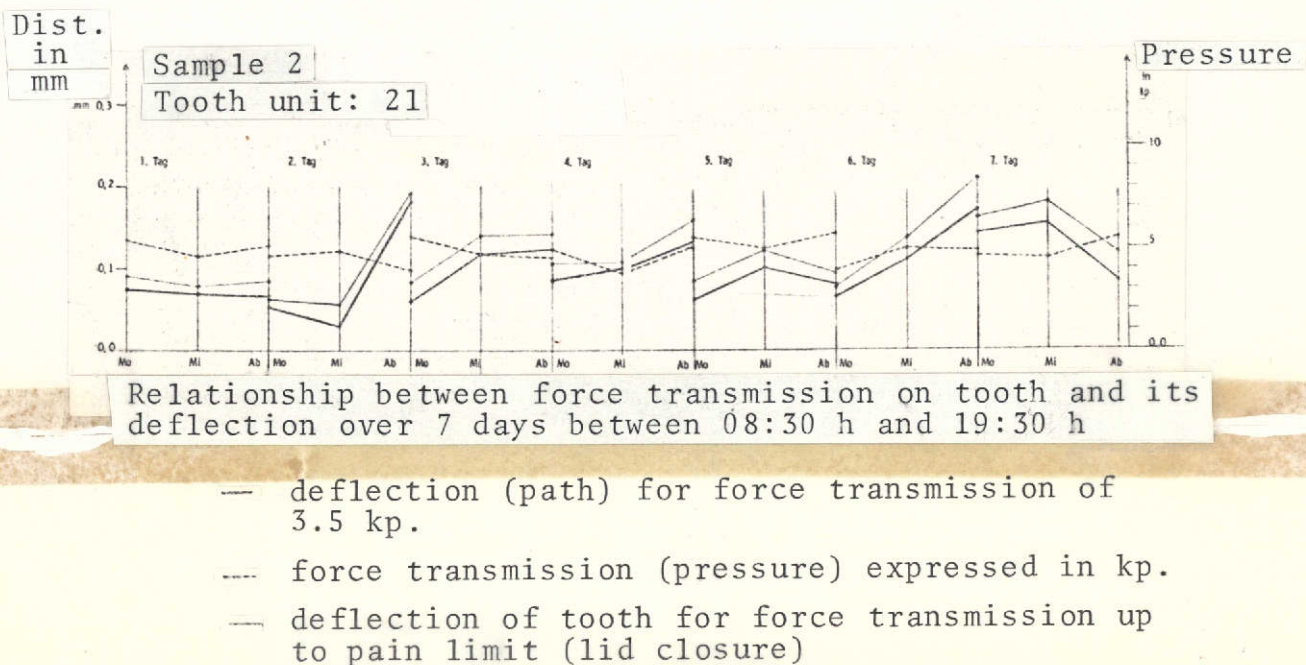


Figure 3. The physiological deflection of one tooth under a definite pressure in the course of one week.

We also chose our (marked) measuring point for application of force 1 mm below the cutting edge. To the extent that fissures were present on the teeth to be measured, we used them to establish the measuring point.

The motion pickup with a brass tip made possible accurate application to the measuring point palatal on the tooth. The motion pickup was held in this position with fast-curing plastic or fixing cement.

As the measurements extended over a period of 7 days at most, the measuring point could be considered constant relative to the antagonists and to the arc of the jaw, except for the physiological inherent mobility of the teeth.

Results

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In the first series of experiments the measurements were done at morning, noon and evening. The second series extended over a week with three measurements daily at the specified times.

One result of our investigations (Figure 3) turned out to be that there were individual variations with respect to the force applied tolerably without pain. The tolerance range was 3.5 to 6.5 kp on one tooth. This finding is not without importance in prevention of pain in extraction of teeth.

We observed that when we applied a definite force of 3.5 kp to a tooth, its looseness in the morning was relatively small in comparison to the other times of day, while there was relatively great looseness for the same force in the evening measurement. Through the studies, which extended over several days, we were able to observe a change in the tendency toward

increasing and decreasing looseness between the noon and evening values. While the tooth looseness decreased from noon to evening on one day, it increased on the next day and decreased on the following day in a rhythmic sequence. The deflection of the tooth from its socket was not proportional to the force applied to it, but was quite dependent on the time of day. Thus, for instance, we could observe that one tooth, on one day, deflected only 0.295 mm for a force of 5.2 kp at noon, while at the same time on the next day it deflected the greater distance of 0.355 mm under the lower force of 4.0 kp.

On the basis of our studies we can assume that the physiological looseness of the teeth is subject to spontaneous rhythmic variations of 48 hours during the noon period.

The answer to the question of whether such variations perhaps also occur in the morning and evening must be reserved for further study.